

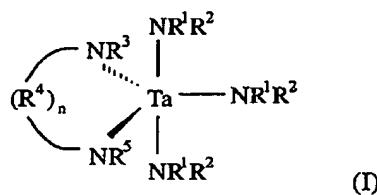
2771-676

**Section I. (Amendments to the Claims)**

Please amend claims 1, 12 and 36, and withdraw claims 12-36, as set out below in the listing of claims 1-36 of the application.

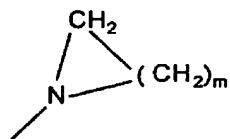
1. (Currently Amended) A precursor composition comprising at least one tantalum species selected from the group consisting of:

(i) tethered amine tantalum complexes of the formula (I):



wherein:

each of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>5</sup> is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, C<sub>6</sub>-C<sub>10</sub> aryl and nitrogen-containing groups such as NR<sup>6</sup>R<sup>7</sup>, wherein R<sup>6</sup> and R<sup>7</sup> are the same as or different from one another and each is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, and C<sub>3</sub>-C<sub>8</sub> cycloalkyl, or alternatively NR<sup>1</sup>R<sup>2</sup> may be represented by the molecular moiety



wherein m = 1, 2, 3, 4, 5 or 6;

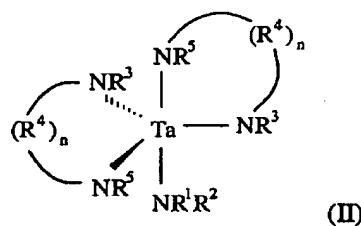
**BEST AVAILABLE COPY**

2771-676

$R^4$  is selected from the group consisting of  $C_1-C_4$  alkylene, silylene ( $-SiH_2-$ ),  $C_1-C_4$  dialkylsilylene and  $NR^8$ , wherein  $R^8$  is selected from the group consisting of H,  $C_3-C_8$  cycloalkyl and  $C_1-C_4$  alkyl; and

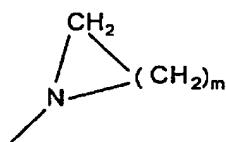
$n$  is 1, 2, 3, or 4, but where  $R^4$  is silylene,  $C_1-C_4$  dialkylsilylene or  $NR^8$ ,  $n$  must be 1;

(ii) tethered amine tantalum complexes of the formula (II):



wherein:

each of  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^5$  is independently selected from the group consisting of H,  $C_1-C_4$  alkyl, silyl,  $C_3-C_8$  cycloalkyl,  $C_1-C_4$  alkylsilyl,  $C_6-C_{10}$  aryl and nitrogen-containing groups such as  $NR^6R^7$ , wherein  $R^6$  and  $R^7$  are the same as or different from one another and each is independently selected from the group consisting of H,  $C_1-C_4$  alkyl, and  $C_3-C_8$  cycloalkyl, or alternatively  $NR^1R^2$  may be represented by the molecular moiety



wherein  $m = 1, 2, 3, 4, 5$  or 6;

2771-676

$R^4$  is selected from the group consisting of  $C_1$ - $C_4$  alkylene, silylene ( $-SiH_2-$ ),  $C_1$ - $C_4$  dialkylsilylene and  $NR^8$ , wherein  $R^8$  is selected from the group consisting of H,  $C_3$ - $C_8$  cycloalkyl and  $C_1$ - $C_4$  alkyl; and

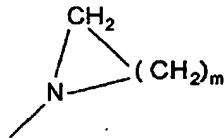
$n$  is 1, 2, 3, or 4, but where  $R^4$  is silylene,  $C_1$ - $C_4$  dialkylsilylene or  $NR^8$ ,  $n$  must be 1; and

(iii) tantalum amide compounds of the formula (III):

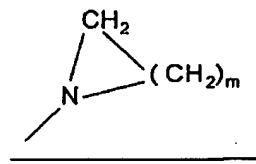


wherein:

~~each of  $R^1$ — $R^4$  is independently selected from the group consisting of  $C_1$ - $C_4$  alkyl, silyl,  $C_3$ - $C_8$  cycloalkyl,  $C_4$ - $C_8$  alkylsilyl,  $C_6$ - $C_{10}$  aryl, or alternatively at least one of  $NR^1R^2$  or and  $NR^3R^4$  may be represented by the molecular moiety~~



wherein  $m = 1, 2, 3, 4, 5$  or  $6$ , and wherein when only one of  $NR^1R^2$  and  $NR^3R^4$  is said molecular moiety



the other of  $NR^1R^2$  and  $NR^3R^4$  has substituents  $R^1$  and  $R^2$  in the case of  $NR^1R^2$  and  $R^3$  and  $R^4$  in the case of  $NR^3R^4$  which are the same as or different from one

2771-676

another and each is independently selected from the group consisting of C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, and C<sub>6</sub>-C<sub>10</sub> aryl, and

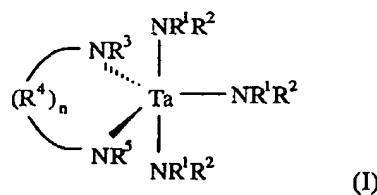
n is 1, 2, 3, or 4.

2. (Original) The precursor composition of claim 1, further comprising a solvent for said tantalum species.
3. (Original) The precursor composition of claim 2, wherein said solvent comprises a solvent species selected from the group consisting of C<sub>6</sub>-C<sub>10</sub> alkanes, C<sub>6</sub>-C<sub>10</sub> aromatics, and compatible mixtures thereof.
4. (Original) The precursor composition of claim 2, wherein said solvent comprises a solvent species selected from the group consisting of hexane, heptane, octane, nonane, decane, toluene and xylene.
5. (Original) The precursor composition of claim 1, comprising at least one tethered amine tantalum complex of formula (I).
6. (Original) The precursor composition of claim 1, comprising at least one tethered amine tantalum complex of formula (II).
7. (Original) The precursor composition of claim 1, comprising at least one tantalum amide compound of formula (III).
8. (Original)  $\eta^2$ -N,N'-dimethylethylenediamino-tris-dimethylaminotantalum.
9. (Original) Bis-diethylamino-tris-dimethylaminotantalum.
10. (Original)  $\eta^2$ -N,N'-diethylethylenediamino-tris-dimethylaminotantalum.
11. (Original)  $\eta^2$ -N,N'-dimethylpropanediamino-tris-dimethylaminotantalum.

2771-676

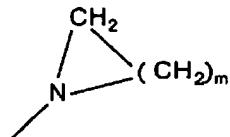
12. (Withdrawn) A method of forming Ta material on a substrate from a precursor, comprising vaporizing said precursor to form a precursor vapor, and contacting the precursor vapor with the substrate to form said Ta material thereon, wherein the precursor comprises at least one tantalum species selected from the group consisting of:

(i) tethered amine tantalum complexes of the formula (I):



wherein:

each of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>5</sup> is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, C<sub>6</sub>-C<sub>10</sub> aryl and nitrogen-containing groups such as NR<sup>6</sup>R<sup>7</sup>, wherein R<sup>6</sup> and R<sup>7</sup> are the same as or different from one another and each is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, and C<sub>3</sub>-C<sub>8</sub> cycloalkyl, or alternatively NR<sup>1</sup>R<sup>2</sup> may be represented by the molecular moiety



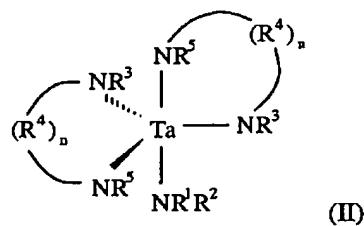
wherein m = 1, 2, 3, 4, 5 or 6;

R<sup>4</sup> is selected from the group consisting of C<sub>1</sub>-C<sub>4</sub> alkylene, silylene (-SiH<sub>2</sub>-), C<sub>1</sub>-C<sub>4</sub> dialkylsilylene and NR<sup>8</sup>, wherein R<sup>8</sup> is selected from the group consisting of H, C<sub>3</sub>-C<sub>8</sub> cycloalkyl and C<sub>1</sub>-C<sub>4</sub> alkyl; and

n is 1, 2, 3, or 4, but where R<sup>4</sup> is silylene, C<sub>1</sub>-C<sub>4</sub> dialkylsilylene or NR<sup>8</sup>, n must be 1;

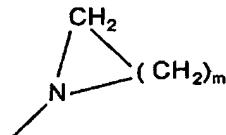
2771-676

(ii) tethered amine tantalum complexes of the formula (II):



wherein:

each of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>5</sup> is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, C<sub>6</sub>-C<sub>10</sub> aryl and nitrogen-containing groups such as NR<sup>6</sup>R<sup>7</sup>, wherein R<sup>6</sup> and R<sup>7</sup> are the same as or different from one another and each is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, and C<sub>3</sub>-C<sub>8</sub> cycloalkyl, or alternatively NR<sup>1</sup>R<sup>2</sup> may be represented by the molecular moiety



wherein m = 1, 2, 3, 4, 5 or 6;

R<sup>4</sup> is selected from the group consisting of C<sub>1</sub>-C<sub>4</sub> alkylene, silylene (-SiH<sub>2</sub>-), C<sub>1</sub>-C<sub>4</sub> dialkylsilylene and NR<sup>8</sup>, wherein R<sup>8</sup> is selected from the group consisting of H, C<sub>3</sub>-C<sub>8</sub> cycloalkyl and C<sub>1</sub>-C<sub>4</sub> alkyl; and

n is 1, 2, 3, or 4, but where R<sup>4</sup> is silylene, C<sub>1</sub>-C<sub>4</sub> dialkylsilylene or NR<sup>8</sup>, n must be 1; and

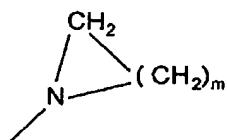
(iii) tantalum amide compounds of the formula (III):

2771-676

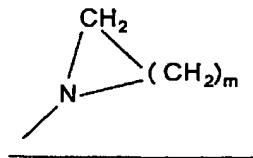


wherein:

each of  $R^1$ — $R^4$  is independently selected from the group consisting of  $C_1$ — $C_4$  alkyl, silyl,  $C_3$ — $C_8$  cycloalkyl,  $C_1$ — $C_4$  alkylsilyl,  $C_6$ — $C_{10}$  aryl, or alternatively at least one of  $NR^1R^2$  or and  $NR^3R^4$  may be represented by the molecular moiety



wherein  $m = 1, 2, 3, 4, 5$  or  $6$ , and wherein when only one of  $NR^1R^2$  and  $NR^3R^4$  is said molecular moiety



the other of  $NR^1R^2$  and  $NR^3R^4$  has substituents  $R^1$  and  $R^2$  in the case of  $NR^1R^2$  and  $R^3$  and  $R^4$  in the case of  $NR^3R^4$  which are the same as or different from one another and each is independently selected from the group consisting of  $C_1$ — $C_4$  alkyl, silyl,  $C_3$ — $C_8$  cycloalkyl,  $C_1$ — $C_4$  alkylsilyl, and  $C_6$ — $C_{10}$  aryl, and

$n$  is 1, 2, 3, or 4.

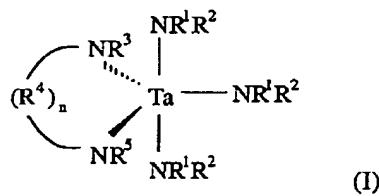
2771-676

13. (Withdrawn) The method of claim 12, wherein said material formed on the substrate is TaN.
14. (Withdrawn) The method of claim 12, wherein the precursor composition further comprises a solvent for said tantalum species.
15. (Withdrawn) The method of claim 14, wherein said solvent comprises a solvent species selected from the group consisting of C<sub>6</sub>-C<sub>10</sub> alkanes, C<sub>6</sub>-C<sub>10</sub> aromatics, and compatible mixtures thereof.
16. (Withdrawn) The method of claim 12, wherein said solvent comprises a solvent species selected from the group consisting of hexane, heptane, octane, nonane, decane, toluene and xylene.
17. (Withdrawn) The method of claim 12, comprising liquid delivery chemical vapor deposition of the Ta material.
18. (Withdrawn) The method of claim 12, comprising deposition of said Ta material on said substrate by a technique selected from the group consisting of chemical vapor deposition and atomic layer deposition.
19. (Withdrawn) The method of claim 12, wherein the substrate comprises a microelectronic device structure.
20. (Withdrawn) The method of claim 19, wherein said Ta material comprises TaN or TaSiN.
21. (Withdrawn) The method of claim 20, further comprising metalizing said substrate after deposition of said Ta material thereon.
22. (Withdrawn) The method of claim 20, further comprising forming a ferroelectric thin film on the substrate.

2771-676

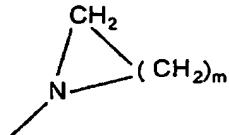
23. (Withdrawn) The method of claim 12, wherein said Ta material comprises TaN.
24. (Withdrawn) The method of claim 12, wherein said Ta material comprises Ta<sub>2</sub>O<sub>5</sub>.
25. (Withdrawn) The method of claim 12, wherein said Ta material comprises BiTaO<sub>4</sub>.
26. (Withdrawn) The method of claim 12, comprising liquid delivery chemical vapor deposition of said precursor to form TaN on the substrate.
27. (Withdrawn) The method of claim 26, further comprising metallizing the substrate with copper.
28. (Withdrawn) The method of claim 26, further comprising forming a ferroelectric thin film on the substrate.
29. (Withdrawn) The method of claim 12, wherein the precursor composition comprises  $\eta^2$ -N,N'-dimethylethylenediamino-tris-dimethylaminotantalum.
30. (Withdrawn) The method of claim 12, wherein the precursor composition comprises bis-diethylamino-tris-dimethylaminotantalum.
31. (Withdrawn) The method of claim 12, wherein the precursor composition comprises  $\eta^2$ -N,N'-diethylethylenediamino-tris-dimethylaminotantalum.
32. (Withdrawn) The method of claim 12, wherein the precursor composition comprises  $\eta^2$ -N,N'-dimethylpropanediamino-tris-dimethylaminotantalum.
33. (Withdrawn) The method of claim 12, comprising liquid delivery chemical vapor deposition.
34. (Withdrawn) A process for making a tantalum complex of formula (I):

2771-676



wherein:

each of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>5</sup> is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, C<sub>6</sub>-C<sub>10</sub> aryl and nitrogen-containing groups such as NR<sup>6</sup>R<sup>7</sup>, wherein R<sup>6</sup> and R<sup>7</sup> are the same as or different from one another and each is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, and C<sub>3</sub>-C<sub>8</sub> cycloalkyl, or alternatively NR<sup>1</sup>R<sup>2</sup> may be represented by the molecular moiety



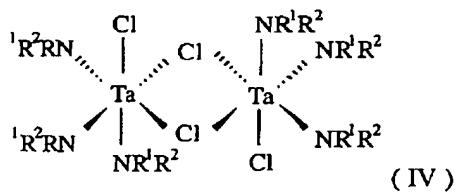
wherein m = 1, 2, 3, 4, 5 or 6;

R<sup>4</sup> is selected from the group consisting of C<sub>1</sub>-C<sub>4</sub> alkylene, silylene (-SiH<sub>2</sub>-), C<sub>1</sub>-C<sub>4</sub> dialkylsilylene and NR<sup>8</sup>, wherein R<sup>8</sup> is selected from the group consisting of H, C<sub>3</sub>-C<sub>8</sub> cycloalkyl and C<sub>1</sub>-C<sub>4</sub> alkyl; and

n is 1, 2, 3, or 4, but where R<sup>4</sup> is silylene, C<sub>1</sub>-C<sub>4</sub> dialkylsilylene or NR<sup>8</sup>, n must be 1;

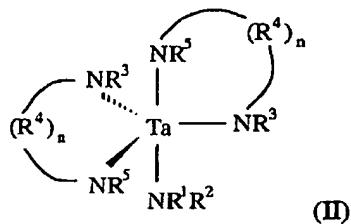
said process comprising reacting a compound of formula (IV) with LiNR<sup>5</sup>(R<sup>4</sup>)<sub>n</sub>NR<sup>3</sup>Li:

2771-676



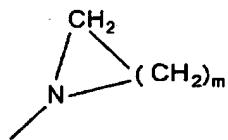
wherein  $R^1 - R^5$  and  $n$  are as defined above.

35. (Withdrawn) A process for making a tantalum complex of formula III:



wherein:

each of  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^5$  is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, silyl, C<sub>3</sub>-C<sub>8</sub> cycloalkyl, C<sub>1</sub>-C<sub>4</sub> alkylsilyl, C<sub>6</sub>-C<sub>10</sub> aryl and nitrogen-containing groups such as NR<sup>6</sup>R<sup>7</sup>, wherein R<sup>6</sup> and R<sup>7</sup> are the same as or different from one another and each is independently selected from the group consisting of H, C<sub>1</sub>-C<sub>4</sub> alkyl, and C<sub>3</sub>-C<sub>8</sub> cycloalkyl, or alternatively NR<sup>1</sup>R<sup>2</sup> may be represented by the molecular moiety



wherein  $m = 1, 2, 3, 4, 5$  or 6;

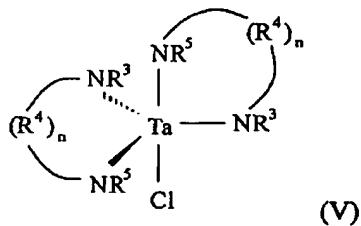
2771-676

$R^4$  is selected from the group consisting of  $C_1-C_4$  alkylene, silylene ( $-SiH_2-$ ),  $C_1-C_4$  dialkylsilylene and  $NR^8$ , wherein  $R^8$  is selected from the group consisting of H,  $C_3-C_8$  cycloalkyl and  $C_1-C_4$  alkyl; and

$n$  is 1, 2, 3, or 4, but where  $R^4$  is silylene,  $C_1-C_4$  dialkylsilylene or  $NR^8$ ,  $n$  must be 1;

said process comprising

reacting  $TaX_5$  with  $LiNR^5(R^4)_nNR^3Li$  to yield a compound of formula (V):



wherein  $R^3-R^5$  and  $n$  are as defined above and  $X = Cl, Br$  or  $I$ ; and

reacting the compound of formula (V) with  $LiN(R^1R^2)$ ,

wherein  $R^1$  and  $R^2$  are as defined above.

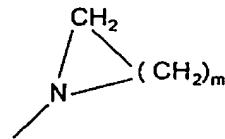
36. (Withdrawn) A process for making a tantalum amide compound of the formula (III):



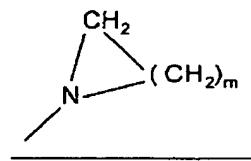
wherein:

each of  $R^1-R^4$  is independently selected from the group consisting of  $C_1-C_4$  alkyl, silyl,  $C_3-C_8$  cycloalkyl,  $C_1-C_4$  alkylsilyl,  $C_6-C_{10}$  aryl, or alternatively at least one of  $NR^1R^2$  or and  $NR^3R^4$  may be represented by the molecular moiety

2771-676



wherein  $m = 1, 2, 3, 4, 5$  or  $6$ , and wherein when only one of  $NR^1R^2$  and  $NR^3R^4$  is said molecular moiety

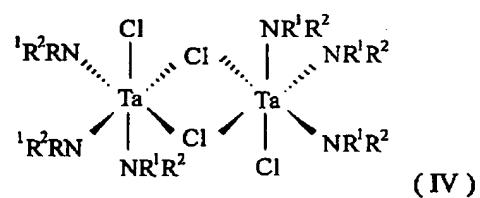


the other of  $NR^1R^2$  and  $NR^3R^4$  has substituents  $R^1$  and  $R^2$  in the case of  $NR^1R^2$  and  $R^3$  and  $R^4$  in the case of  $NR^3R^4$  which are the same as or different from one another and each is independently selected from the group consisting of  $C_1-C_4$  alkyl, silyl,  $C_3-C_8$  cycloalkyl,  $C_1-C_4$  alkylsilyl, and  $C_6-C_{10}$  aryl, and

$n$  is 1, 2, 3, or 4;

said process comprising

reacting compound (IV) with  $LiNR^3R^4$ :



wherein  $R^1-R^4$  are as defined above.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**